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Remarks/Arguments

1. Claims 1-14 were pending at the time of examination. Examiner rejected all 14 claims. Applicant appreciates Examiner's careful review of the present application as evidenced by the Office Action of February 26, 2007, and requests reconsideration of the currently presented claims.

2. **Amendments to the Claims**: Claim 1 has been amended to recite at least two oscillatory members assembled within the housing, spaced a distance apart, wherein the vibration of the oscillatory members passes acoustic energy back and forth between the oscillatory members, thereby causing the space between the oscillatory members to alternatingly expand and contract, thereby increasing the shear and compression forces that are exerted on the process liquid, and wherein the compression and shear forces are exerted on a total volume of the process liquid. Language supporting this amendment is found in the Specification as originally filed in paragraph [0016], which describes the propagation of the acoustic waves among the baffles and housing wall and in paragraph [0019], which describes the piezoelectric members arranged lengthwise within the housing and their oscillation in a direction transverse to the general direction of flow through the device. In the Detailed Description, Paragraph [0041] describes the propagation of the acoustic waves from the baffles through the process liquid to other baffles to the wall of the housing and back through the process

liquid toward the baffles and paragraph [0046] describes the oscillation of the piezoelectric members. Language in paragraph [0014] describes how the redistribution of the process liquid through the devices increases the probability that the acoustic energy generated by the oscillatory members acts on every molecule of the process liquid, i.e., on the total volume of the process liquid. Language from claim 2 relating to a longitudinal axis of the housing was incorporated into claim 1 and deleted from claim 2. Claim 14 was amended to include limitations similar to those introduced in claim 1. The amendments to claim 14 are supported by language in the same paragraphs of the Specification that were cited above with regard to the amendments made to claim 1. Claims 2 and 7 were amended to correspond to amended claim 1. No new subject matter is introduced with this amendment and Applicant respectfully requests approval and entry of the amended claim.

3. **Rejections under 35 U.S.C. § 102(b):** Examiner rejected claims 1, 6, and 12 – 14 as being anticipated by Grange et al., U.S. Patent 4,129,387. Grange et al. discloses a device with a vibrating reed or blade mounted between tuning plates. The process liquid flows from a jet orifice into the passageway between the mounting plates, past the vibrating reed. The flow of the process liquid causes the reed to vibrate. The vibrating reed is fixed at one end to the device, with the free end oscillating. In such a setup, i.e., with one end fixed and the other end oscillating, it is impossible to preclude

that some of the liquid flows through the device and, thus, it is impossible to ensure that the forces generated by the reed perform work on every particle in the process liquid. The base of the reed is constrained in its holder and does not oscillate. In the following discussion, we shall refer to a reed that moves up and down, whereby a flow path is always present. With the exception of the time the reed is in its central position, the flow path has what we shall refer to as a large gap path and a small gap path, whereby the two paths alternate from one side to the other of the reed as the reed oscillates. When the reed is in its central position, the flow paths are evenly sized on both sides of the reed. Maximum work is exerted on the fluid only at the tip of the reed. Thus, the high forces generated by the oscillations of the reed act on the process liquid only during the time it is flowing past the tip of the reed. These high forces generated at the tip of the reed are quickly dissipated in the process liquid and no longer exert high forces on the process liquid, once the liquid has flowed past that area. Looking at the reed straight on from the thin end, it is clear that, at least on the side with the large gap path, a straight unobstructed flow path extends from in front of the reed to the far end of the reed. This increases the statistical probability that some of the liquid is able to flow past the reed in the large gap flow path, without being sufficiently worked on by the forces generated by the oscillating reed. In the case of homogenization, that risk may be acceptable. In the

case in which the device is used to sanitize process fluids, it is an unacceptable risk to have particles able flow through the device, without being sanitized.

4. By contrast, the device of the present application includes more than one oscillating member, spaced a distance apart from each other. The deflection movements of the members relative to one another cause the spaces between the oscillatory members to alternatingly expand and contract. When the space expands, process flow is drawn into the space and rarefaction forces are exerted on the process liquid; when the space contracts, compression and shear forces on the process liquid are greatly increased.

5. The significant difference acoustically between the Grange et al. reed device and the device claimed has to do with how the acoustic energy is conserved and propagated within the device. It may help to understand the differences between these two devices by thinking of the differences between a reed and a bell. The reed is similar to a ruler with one end fixed against a table, while the device of the present application is more like a bell or wine glass. Hitting the tip of the reed or ruler causes it to vibrate and results in a hum. The vibrations are not picked up by other vibrating members within the housing, but instead, are dissipated into the surrounding fluid. Hitting a bell or wine glass, on the other hand, results in a ringing sound, rather than a hum. This is because

acoustic energy is reflected in the resonant cavity. The device of the present application is more similar to a bell than the ruler or reed arrangement, because the plurality of oscillating members within a housing that conserves acoustic energy, rather than dissipates it, encourages resonance. With the device claimed in the present application, the plurality of oscillatory members in the housing reflects the energy from disk to disk, to the housing, and back again to the disk, or, in the case of the embodiment with the piezoelectric members, from piezoelectric member to piezoelectric member, to the housing, and back again. This is what is referred to as "fly-wheeling" in the Specification of the present application. This fly-wheeling, or passing back and forth of the energy generated by the flow conserves energy within a confined space, and serves to increase the dwell time of the fluid within the device and to perform more work on the process fluid over a greater distance of flow. The Grange et al. reed device, on the other hand, having only a single oscillatory member that is fixedly attached at one end and not freely oscillating, releases acoustic energy at its tip only. The high forces in the energy are not maintained, but rather, dissipate due to friction or work done on the fluid at the tip area, and are not propagated further throughout the device.

6. Applicant submits that the Grange et al. disclosure does not disclose all the elements and limitations cited in independent claims 1 and 14 of the present application, that Grange et al. does not anticipate the claimed invention, and that, therefore, these

independent claims contain allowable subject matter. Claims 6 and 12 – 13 are dependent claims and are, thus, also allowable, as they contain the subject matter of claim 1. Applicant requests that Examiner withdraw this rejection under 35 U.S.C. § 102(b) and allow these claims.

7. **35 U.S.C. § 103(a) Rejection:** Examiner further rejected claims 2 – 5 as being unpatentable over Grange et al. and further in view of Hemker (U.S. Patent 3,856,270). The Hemker device is for mixing fluids and, to this end, includes a series of plates with channels and apertures that alternately divide and subdivide and recombine a fluid stream. The plates are firmly and fixedly mounted within the housing and maintained in "snug face-to-face contacting, fluid-tight relationship." Hemker, col. 3, lines 8 – 12. The fluid flows from the aperture in one plate directly into the channel of an adjacent plate. Openings 29, 31, 33, and 35 extend through the plate 15 and connect the respective ends of the channels 17 and 19 with the adjacent ends of the channels 23 and 25. Hemker, col. 3, lines 25 – 28. All of the channels are of like dimensions, to avoid the presence of pressure differentials within the apparatus. Hemker, col. 3, lines 44 – 46. In other words, Hemker teaches a device that <u>minimizes</u> turbulent flow.

8. Hemker does not disclose a device with a plurality of oscillating members that are constructed to oscillate as the fluid passes through the device under a pressure

differential. Examiner asserts that it would have been obvious to one of ordinary skill in the art to place Hemker's vertically oriented perforated baffle plates with Grange's housing, so that an intimate blending of all portions of the liquid is additionally accomplished. The Hemker and Grange et al. devices are constructed to achieve different objectives, albeit both dealing with fluids. The Hemker device is to mix or blend fluids, the Grange et al. device is to homogenize fluids. Blending fluids requires only that fluids be brought together; homogenizing fluids, on the other hand, does not require that fluids be brought together, but rather, that two or more types of globules within a fluid be held in suspension together. For example, milk contains fat globules, which are large, and milk globules, which are smaller than the fat globules. The fat globules tend to separate out from the milk and rise to the top. Homogenization breaks the large globules into smaller globules, so that they will tend to stay in suspension with the milk globules. The orientation of the baffle plates is irrelevant to homogenization, mixing, or sanitizing. Placing the Hemker baffle plates within the Grange et al. housing will not result in the generation of acoustic energy from the flow energy and will not result in sanitization of a process liquid, as is claimed by the device of the present application. The combination of Grange et al. and Hemker does not teach, suggest, or motivate one to provide a plurality of <u>oscillating members</u> within a housing, wherein flow energy and oscillations of the oscillating members create an acoustic energy that is then

propagated back and forth between the oscillating members. Nor does the combination of the two cited references disclose all the elements of the claimed invention. There is no way to combine the plates of Hemker with the oscillating reed of Grange et al., to obtain the device of the present invention.

9. Applicant further notes that claims 2 – 5 are dependent claims that all depend directly or indirectly from claim 1 and that claim 1 contains allowable subject matter. The dependent claims contain the same allowable subject matter of the base and any intervening claims, thus, these claims 2 – 5 are also allowable.

10. Applicant respectfully submits that he has successfully traversed the rejection under 35 U.S.C. § 103(a) and requests that Examiner withdraw this rejection of claims 2 – 5.

11. Examiner further rejection claims 7 – 11 under 35 U.S.C. § 103(a) as being unpatentable over Grange et al. in view of Branson. Claims 7 – 11 recite oscillatory members that are piezoelectric members. Applicant refers to the paper filed on December 11, 2006, which provided a lengthy discussion of the Branson device. The transducers 22 are arranged to form a chute 18 through the water bath. The inlet 14 is at the lower right corner, the outlet 16 at the upper right corner. The flow of the fluid through the water bath is, thus, generally from the lower right corner to the upper right

corner. Examiner asserts that Branson teaches a pair of piezoelectric members that generate sonic energy, with the acoustic waves emanating from the piezoelectric members that "inherently travel in a direction transverse to the longitudinal axis of the tank, ..." The longitudinal axis of the device claimed in claim 1 of the present application extends from the inlet to the outlet of the housing, so that the flow of process liquid is generally in a direction along the longitudinal axis. The arrangement of the piezoelectric members as recited in claim 7 ensures that the shear forces and compression forces generated by the acoustic energy emanating from the piezoelectric members work on the total volume of the process liquid. This is not the case with the Branson device. It is unclear as to what would be a longitudinal axis of the water bath, as shown in FIGS. 1 and 2, other than an axis that runs between the side identified as 10 and the wall identified as 33, as shown in FIG. 2. The water in the bath does not flow along this axis, however, but flows in a generally diagonal path as indicated by flow arrows shown in FIG. 1. The waves emanating from the elements 22 do not emanate in a direction that is inherently transverse to the longitudinal axis, nor in a direction that is transverse to the flow of liquid through the bath, nor do they do work on a total volume of the liquid. The transducers are arranged to form a chute 18 within the water bath, within which free-falling particles are cleaned. The waves emanate from the transducers inward toward the center of the chute 18. See Branson, FIG. 1 and col. 3,

line 71 – col. 4, line 1. A great portion of the liquid in the water bath is outside this area and not subjected to the energy generated by the transducers. Furthermore, the "flow partition disposed between the piezoelectric members" does not have all the limitations for the flow partition recited in claim 8 of the present application, which is a flow partition disposed between the piezoelectric members <u>and extending in a direction parallel to the longitudinal axis</u>.

12. Examiner asserts that it would have been obvious to one of ordinary skill in the art, to place Branson's piezoelectric members into Grange's housing, so that fluids with different densities are treated ultrasonically. Applicant submits that the Branson reference does not disclose all the limitations of the piezoelectric members of claims 7 – 13 and that the combination of Grange et al. and Branson do not disclose, teach, motivate, or suggest one to combine the use of piezoelectric members within a housing, such that the acoustic waves emanate from the piezoelectric members in a direction transverse to the longitudinal axis of the housing in a manner to exert shear and compression forces on the complete volume of fluid flowing through the device.

13. Applicant submits that the combination of Grange et al. and Branson do not render the invention of the present application as claimed obvious. Applicant further notes that claims 7 – 11 depend from claim 1, which contains allowable subject matter.

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Applicant requests that Examiner withdraw the 35 U.S.C. § 103(a) rejection of claims 7 – 11 and allow these claims.

14. This paper is being filed within the fourth month of the Final Office Action. A petition for a one-month extension and authorization to deduct the appropriate fees from the deposit account of the undersigned are also included.

Respectfully submitted,

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